Física 1 – Ciências Moleculares

Caetano R. Miranda

AULA 2 – 23/08/2023

crmiranda@usp.br

Aula anterior – 21/08/2023

- Paixão pela Física
- Apresentação do curso
- Tour sobre as atividades a serem realizadas

Devolutiva:

- Como foi a aula hoje ? (Moodle)

https://forms.gle/TNRKfLb9stgG6b5FA

Turma 33 – 21/08/2023

Física I - CCM

- Método: Fenômeno Físico - Formalismo - Aplicação
  - Demonstração e discussão do fenômeno físico
  - Modelo teórico
  - Aplicações no cotidiano (Fixação – Listas de exercícios)
  - Experimentações imersivas e lúdicas
  - Estratégias ensino-aprendizagem

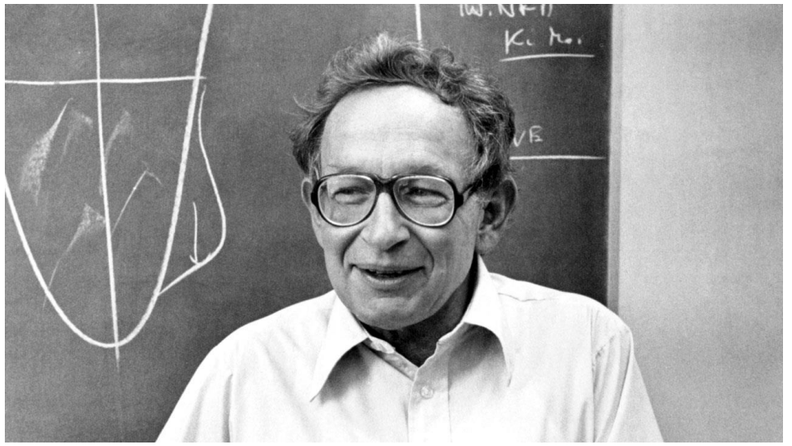
- Organização: Experiências + Fundamentos + Discussões

- Avaliação: NOTA: 0.2*P1 + 0.3*P2 + 0.5*(Média_Entregas)

Aprovado(a) se NOTA ≥ 5.0

Cronograma

DATA	aula nº	Segundas (14:00h - 15:45h) - Sala Turma 33	DATA	aula nº	Quartas (14:00h - 15:45h) - Sala Turma 33	DATA	aula nº	Quintas (14:00h - 15:45h) - Sala Turma 33	
21/08	1	Apresentação do Curso	23/08	2	Experimentação 1 - Escalas	24/08	3	Escalas	
28/08	4	Experimentação 2 - Mov. em 1 D	30/08	5	Mov. em 1D	31/08	6	Mov. em 1D	
04/09			06/08			07/09		SEMANA TRABALHO	
11/09	7	Experimentação 3 - Angry Birds	13/09	8	Mov. em 2D e 3D	14/09	9	Mov. em 2D e 3D	ENTREGA 1
18/09	10	Experimentação 4a - Dinâmica	20/09	11	Principios da Dinamica - Leis de Newton	21/09	12	Principios da Dinâmica - Leis de Newton	
25/09	13	Experimentação 4b - Principia	27/09	14	Principios da Dinâmica - Leis de Newton	28/09	15	Revisão - P1 - Check point - Projeto	
02/10		PROVA I	04/10	16	Experimentação 5 - Energia e Trabalho	05/10	17	Energia e Trabalho	
09/10	18	Energia e Trabalho	11/10	19	Energia e Trabalho	12/10		FERIADO - N. S. Aparecida	
16/10	20	Experimentação 6 - Física dos Desenhos Animados	18/10	21	Simetria e Conservação	19/10	22	Simetria e Conservação	ENTREGA 2
23/10	23	Experimentação 7 - Colisões	25/10	24	Colisões	26/10	25	Colisões	
30/10	26	Experimentação 8 - VR / Sonificação	01/11	27	Forças de Interação - Sala Invertida	02/11		FERIADO - FINADOS	
06/11	28	Forças de Interação	08/11	28	Revisão - P2 - Check point - Projeto	09/11		PROVA II	
13/11			15/11			16/11		SEMANA TRABALHO	
20/11		FERIADO - Consciência Negra	22/11	30	Experimentação 9 - Aprendizado de Máquina	23/11	31	Rotação e Momento Angular	ENTREGA 3
27/11	32	Física dos Esportes e Parques de Diversão	29/11	33	Rotação e Momento Angular	30/11	34	Experimentaçao 10 - Dança e Robótica	
04/12	35	Forças Inerciais	06/12	36	Forças Inerciais	07/12	37	Check point - Projeto	
11/12		PROJETOS	13/12		PROJETOS	14/12		VISTA	ENTREGA 4
18/12		PROVA - SUB - VISTA	20/12		VISTA	21/12			



SERIA O TODO A SOMA DAS PARTES ?
O TODO NÃO É TUDO …

Reducionismo vs Complexidade (Emergência)

4 August 1972, Volume 177, Number 4047 SCIENCE

More Is Different

Broken symmetry and the nature of the hierarchical structure of science.

P. W. Anderson

The reductionist hypothesis may still be a topic for controversy among philosophers, but among the great majority of active scientists I think it is accepted without question. The workings of our minds and bodies, and of all the animate or inanimate matter of which we have any detailed knowledge, are assumed to be controlled by the same set of fundamental laws, which except under certain extreme conditions we feel we know pretty well.

It seems inevitable to go on uncritically to what appears at first sight to be the reductionist consequence of these laws. In principle the statement is obviously true that from a sufficient knowledge of the fundamental laws of physics and chemistry one could extrapolate the behavior of human beings, say, or of human institutions. But in fact such statements are quite obviously not true in practice because the extrapolations are impossible to carry out in detail. Accordingly, although everything we do is ultimately governed by those laws, in practice the understanding of social institutions, or even of human beings, is not to be found in the Schrödinger equation. Instead, at each level of complexity entirely new laws, concepts, and generalizations are necessary, and this hierarchy of structures depends on the universal laws in a way which is quite analogous to the dependence of structures on the fundamental laws of physics. Psychology is not applied biology, nor is biology applied chemistry. We can now see that the whole is greater than the sum of the parts not because of some mysterious new force or principle, but because of the immense practical difficulty of reconstructing the description of the whole from the description of the parts.

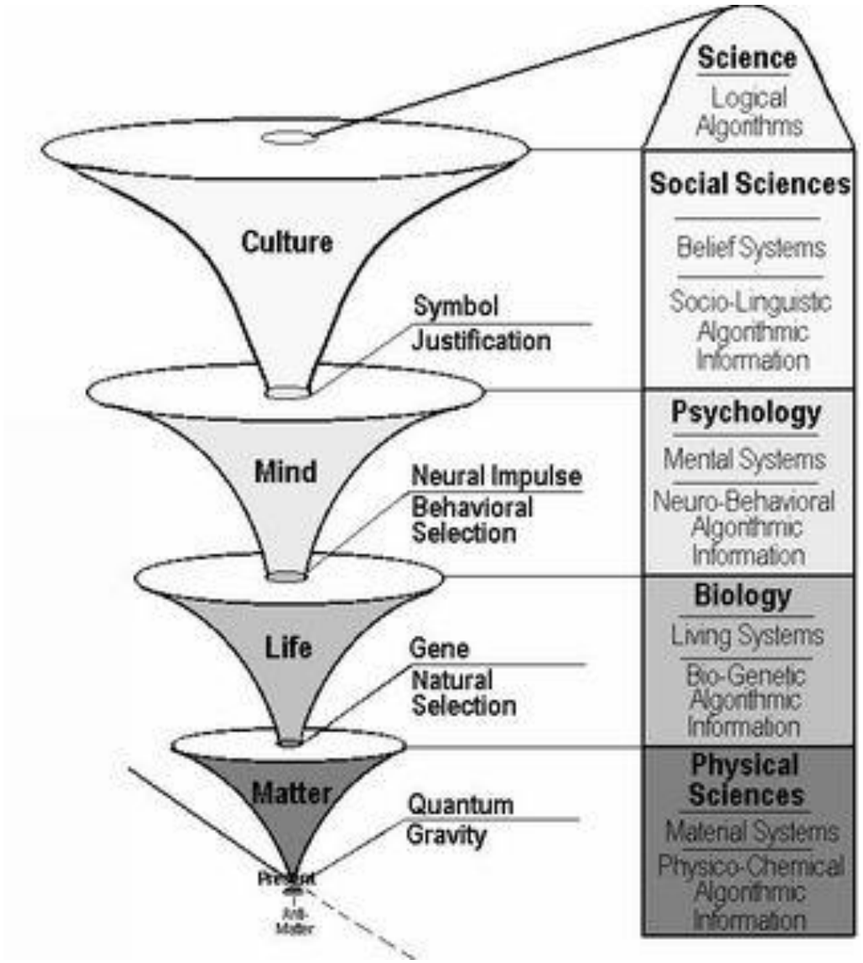
Even when the parts do not interact with one another appreciably, nevertheless in order to understand the way they behave collectively we have to study explicitly how they behave collectively. The behavior of a neon gas discharge tube is quite different from that of a single neon atom, a bubble chamber is quite different from a single proton, and the human mind is quite different from the activity of single brain cells or even groups of brain cells. It is only at each stage of complexity that entirely new properties appear, and the understanding of the new behaviors requires research which I think is as fundamental in its nature as any other. That is, it seems to me that one may array the sciences roughly linearly in a hierarchy, according to the idea: The elementary entities of science X obey the laws of science Y.

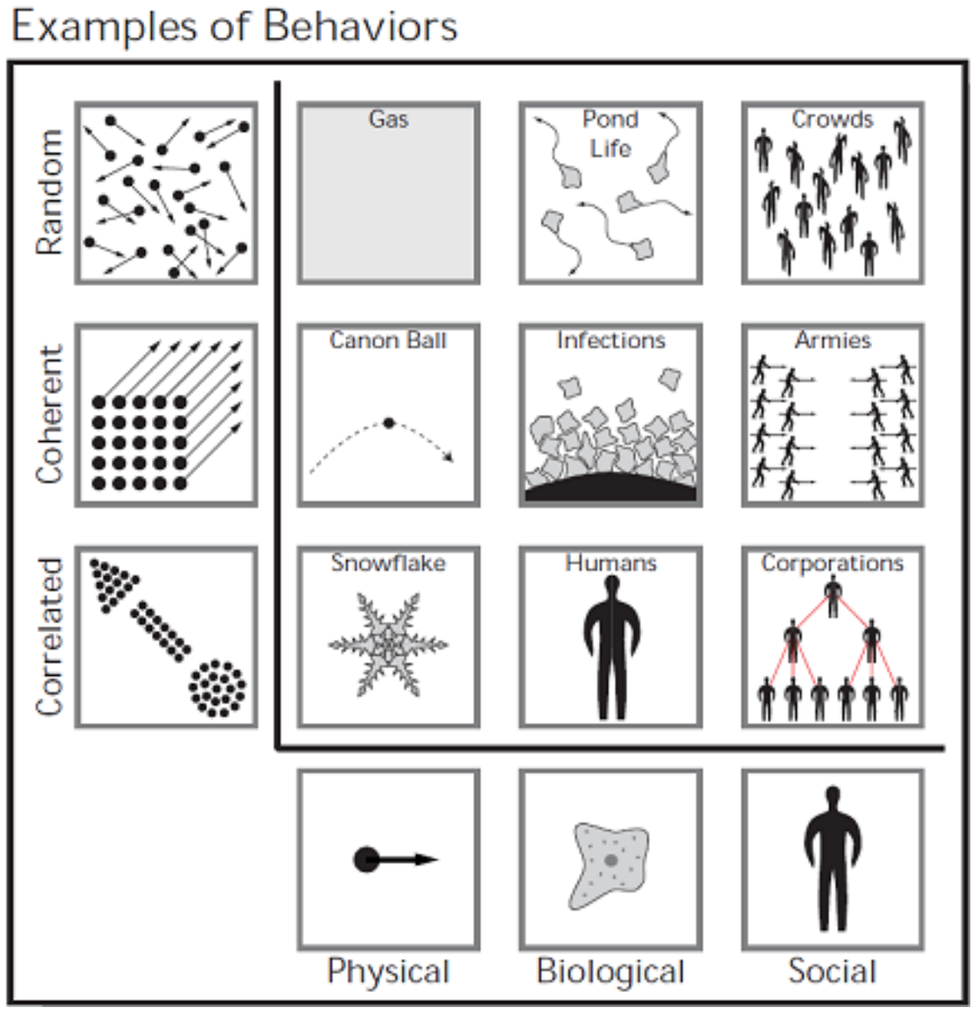
X	Y
solid state or many-body physics	elementary particle physics
chemistry	many-body physics
molecular biology	chemistry
cell biology	molecular biology
•	•
•	•
•	•
psychology	physiology
social sciences	psychology

The constructionist hypothesis breaks down when confronted with the twin difficulties of scale and complexity. The behavior of large and complex aggregates of elementary particles, it turns out, is not to be understood in terms of a simple extrapolation of the properties of a few particles. Instead, at each level of complexity entirely new properties appear, and the understanding of the new behaviors requires research which I think is as fundamental in its nature as any other. That is, it seems to me that one may array the sciences roughly linearly in a hierarchy, according to the idea: The elementary entities of science X obey the laws of science Y.

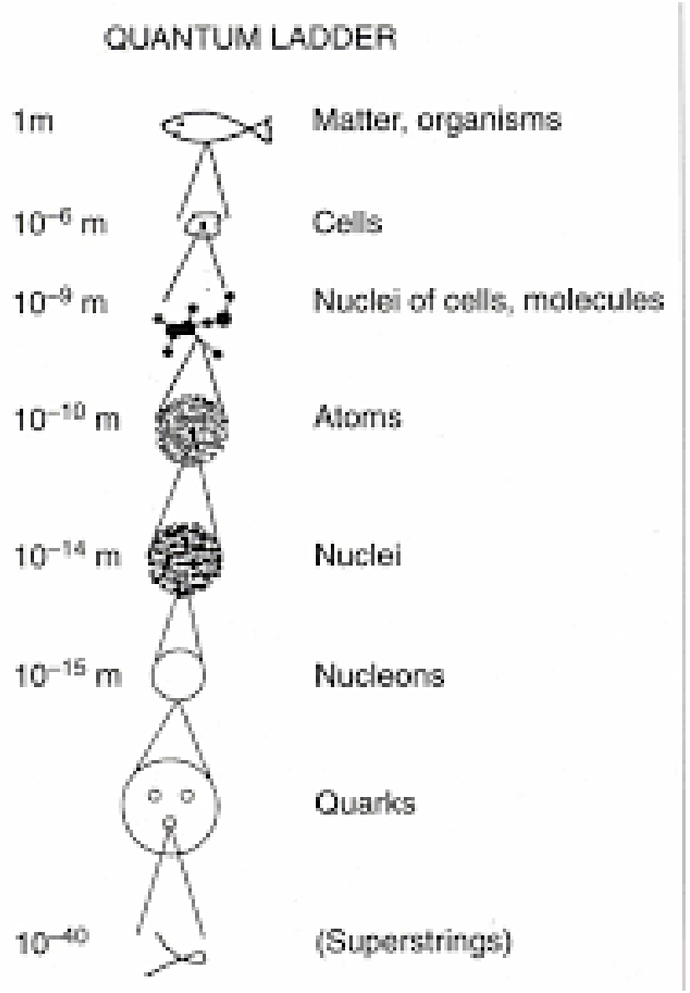
“the theory of everything is not even remotely a theory of every thing”

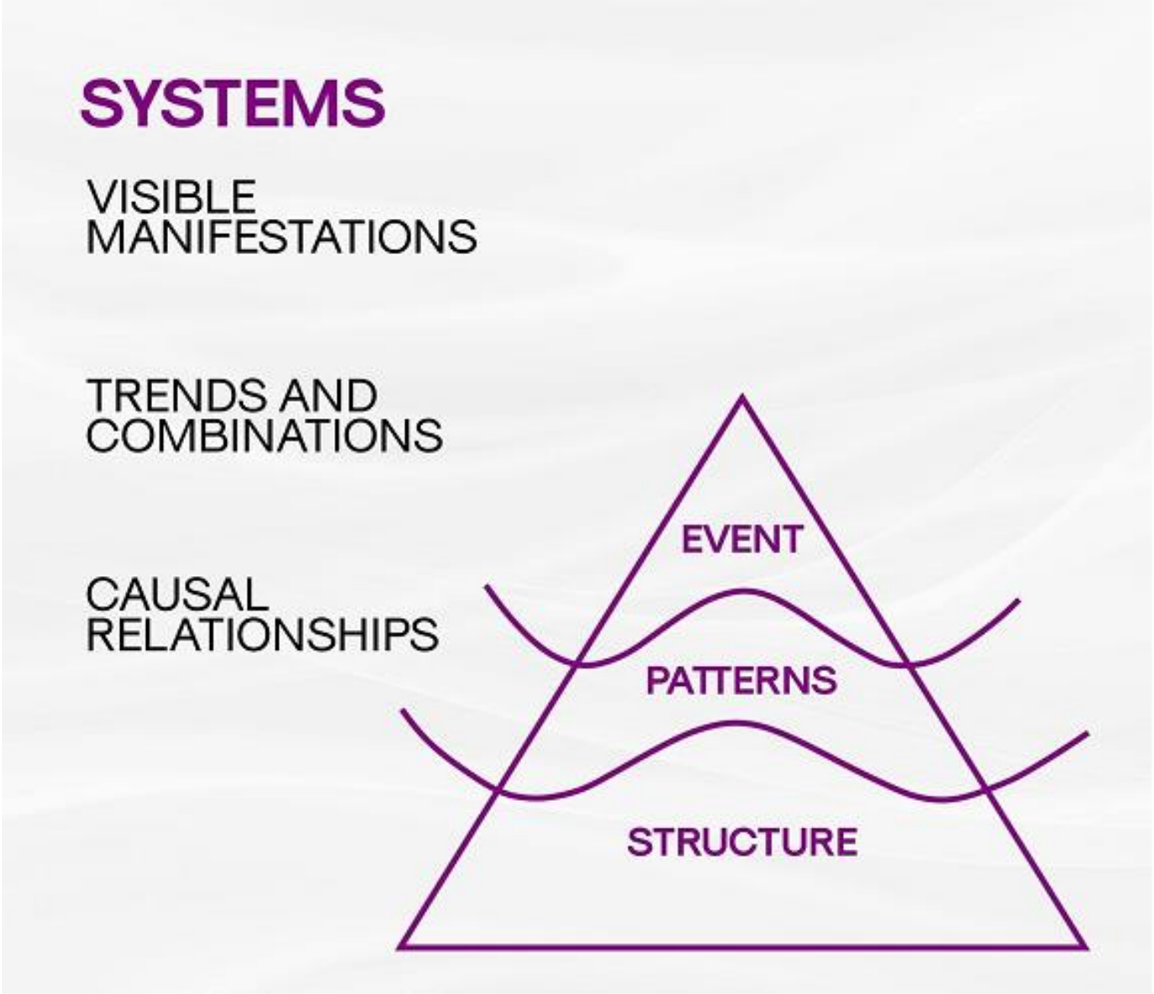
Reducionismo vs Complexidade (Emergência)





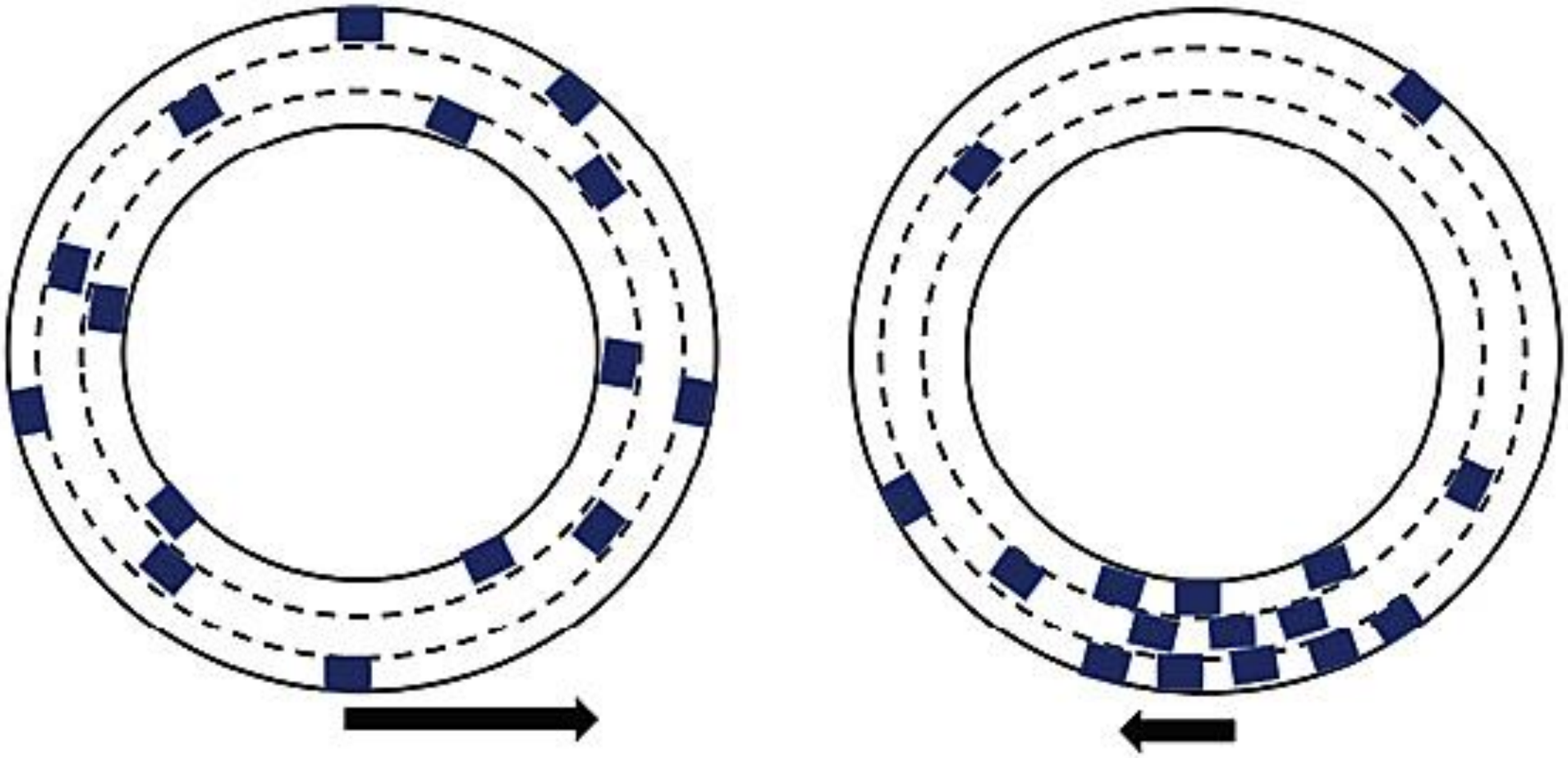
Reducionismo vs Complexidade (Emergência)





Emergência

https://traffic-simulation.de/ring.html



MODELOS FÍSICOS

Experiência 1 – Construindo modelos físicos

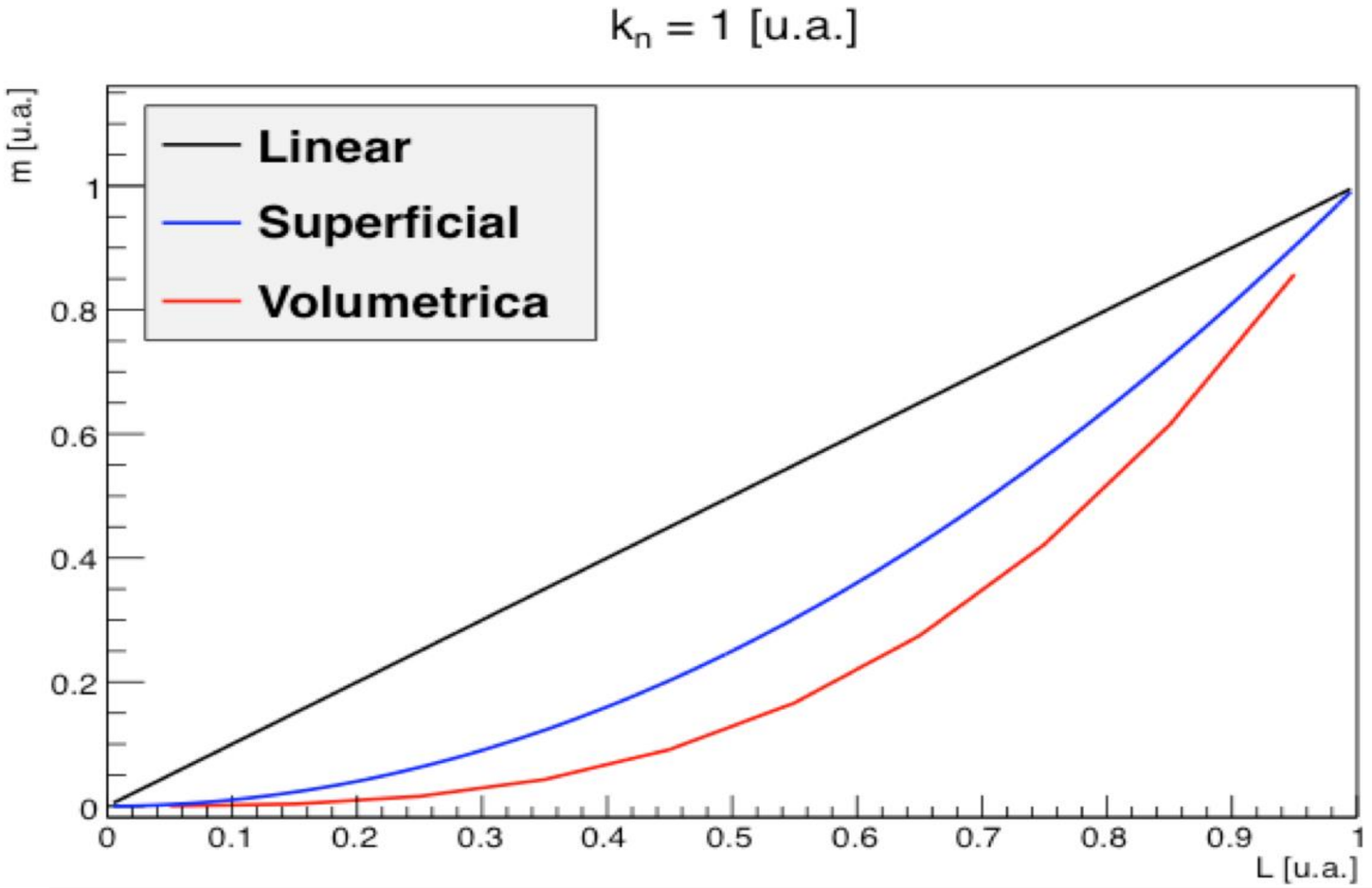
Guerra de Papel

Material:

Folhas A4, Jornal ou Caderno

Objetos euclidianos

"Como a massa de um objeto depende de suas dimensões espaciais ? "



"... podemos escrever que, de forma geral, a massa de um objeto depende da sua densidade x uma potência da sua dimensão característica, sendo n um número inteiro (1, 2 ou 3)."

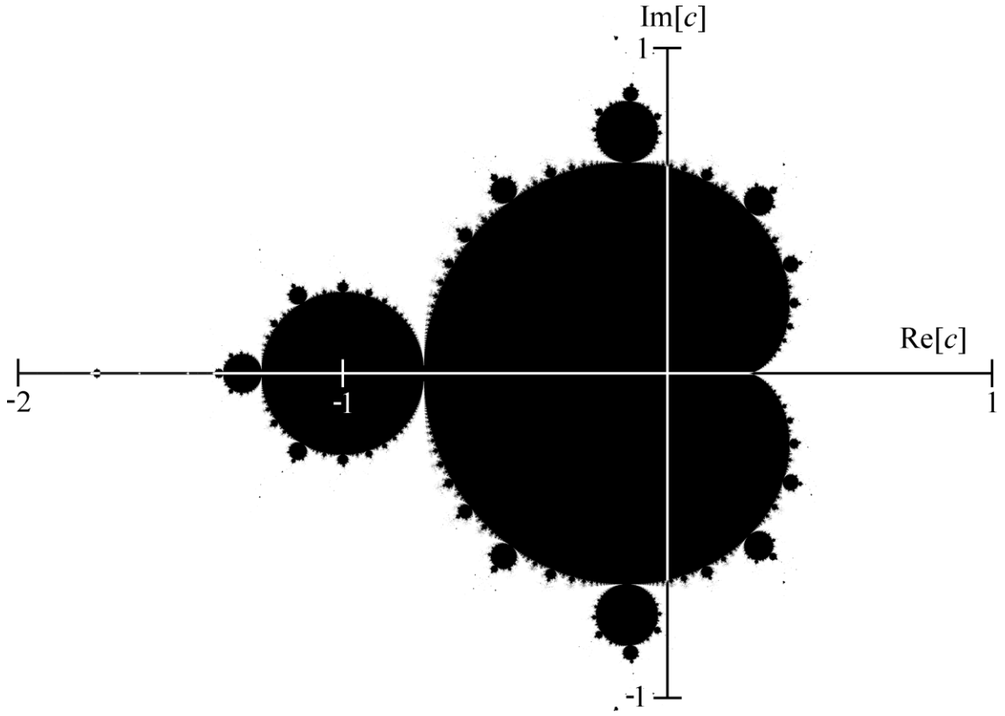
$$m = k_n L^n$$

Experiência 1 - Escalas

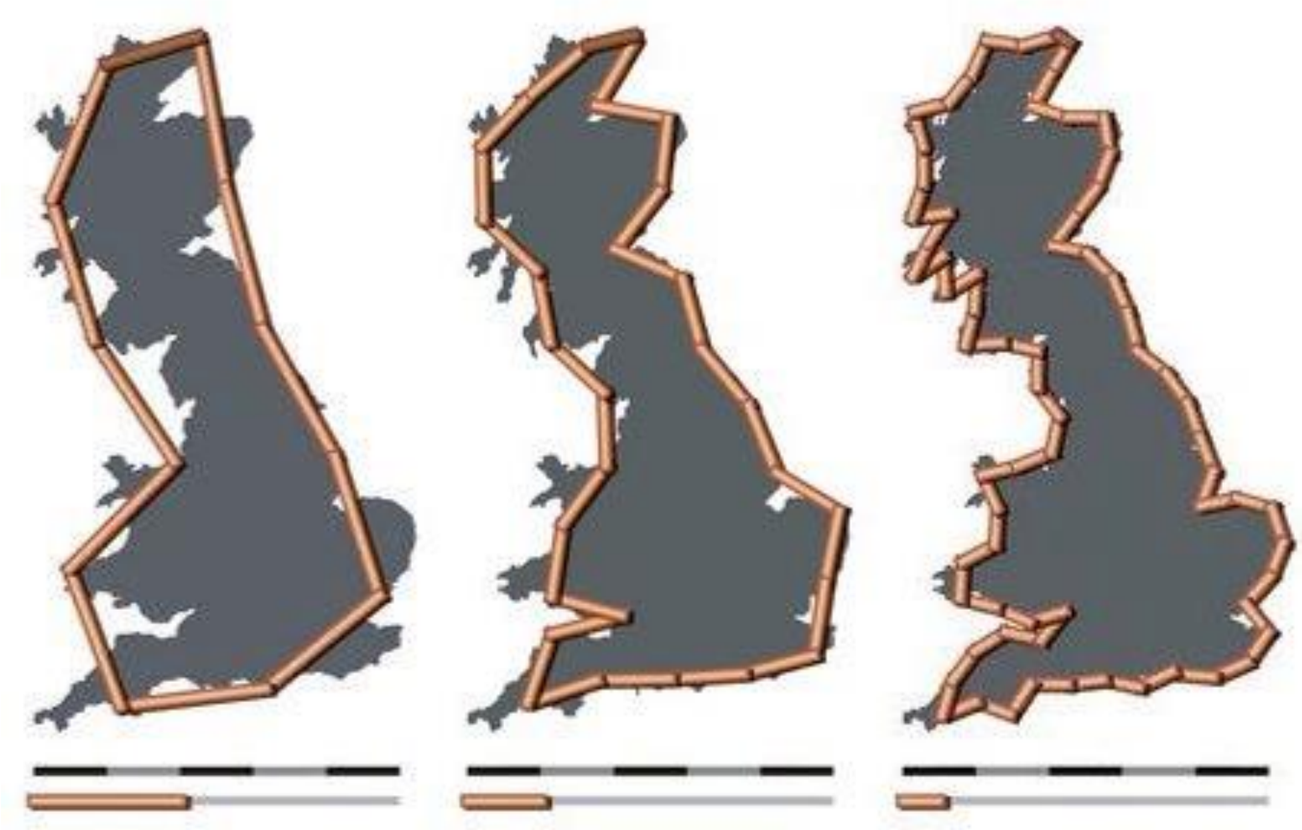
Seria n é sempre um número inteiro?

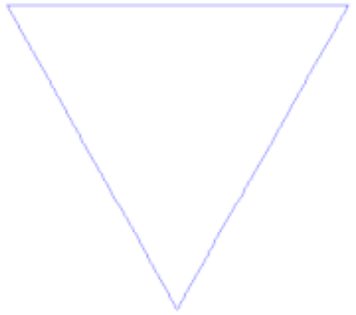
Conjunto de Mandelbrot

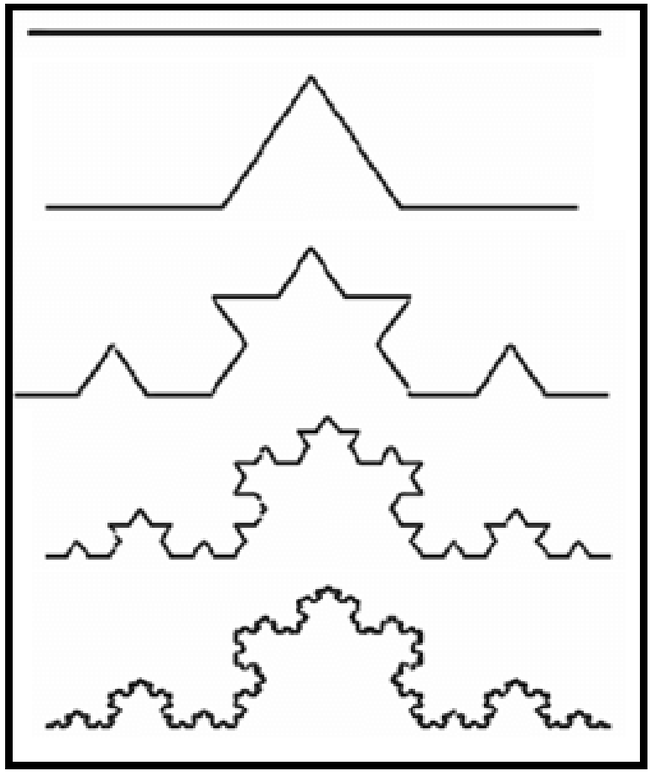
$$\begin{cases} z_0 & = & 0 \\ z_{n+1} & = & z_n^2 + c \end{cases}$$



Medidas – Curva de Koch

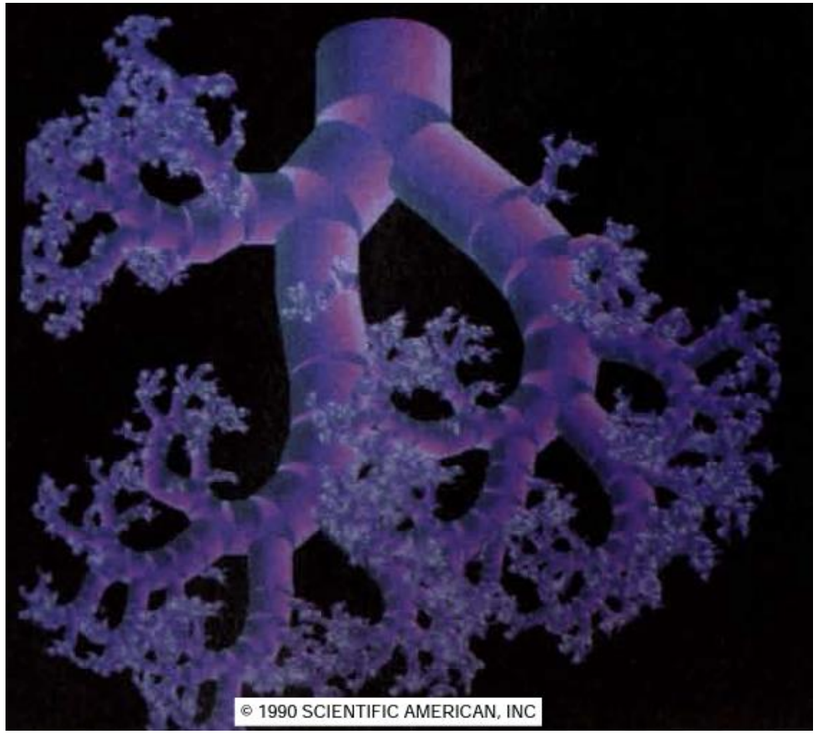


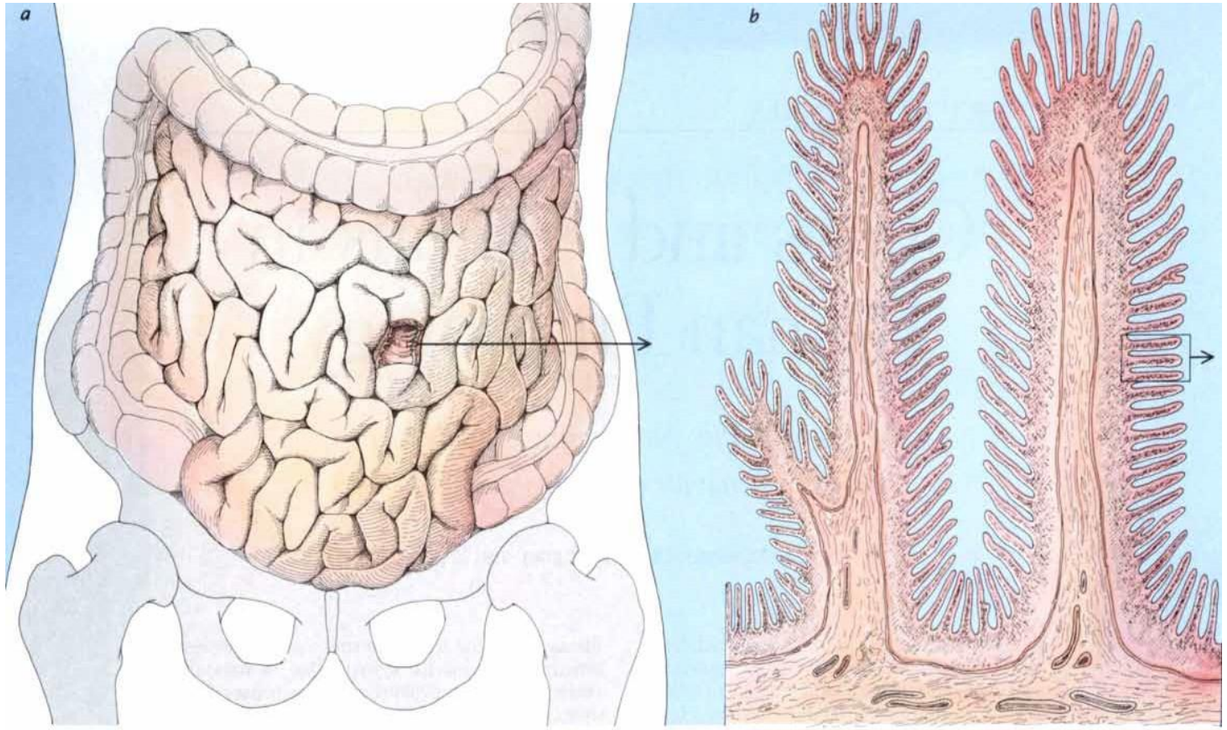




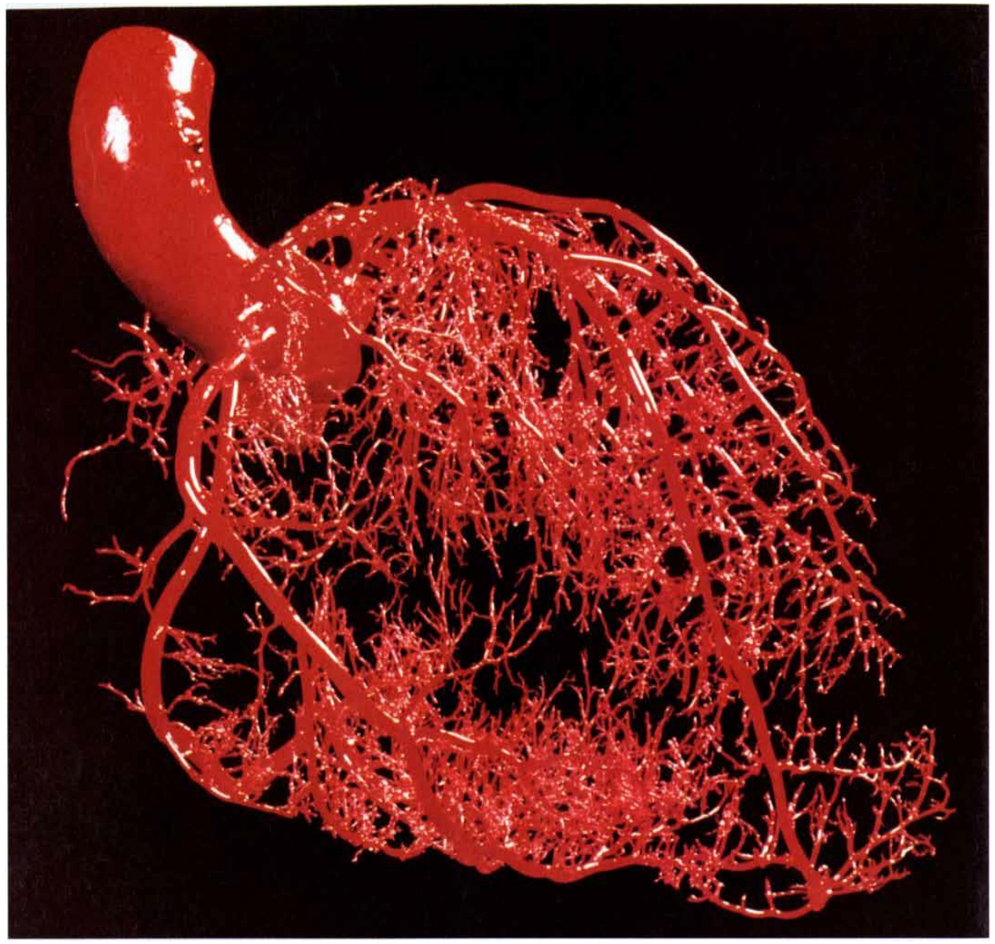
A primeira iteração é um triângulo equilátero, e cada iteração sucessiva é formada pela adição de curvas externas a cada lado do estágio anterior, formando triângulos equiláteros menores. (Área finita, perímetro infinito)

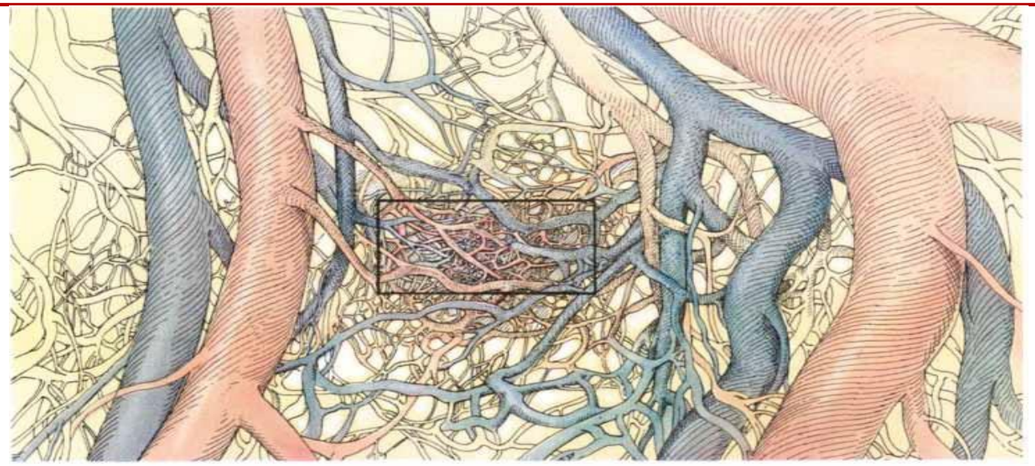
Fractais na fisiologia humana

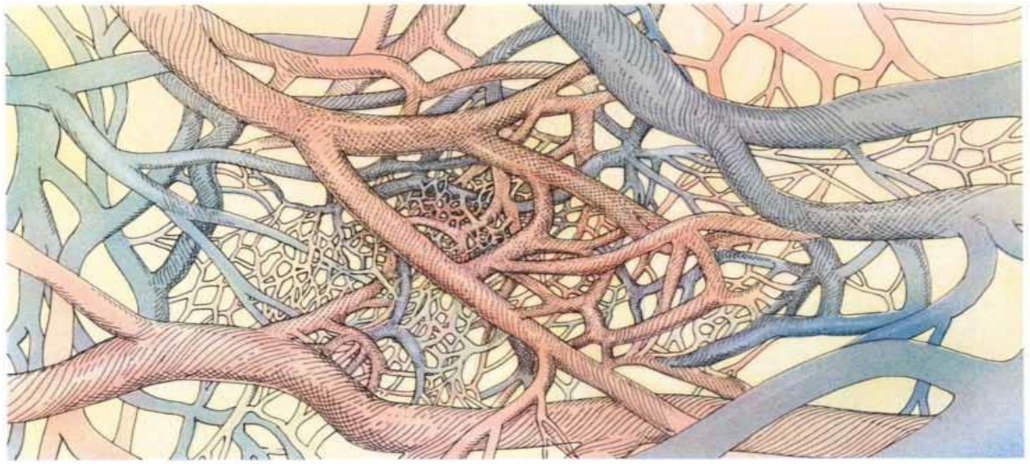




Fractais na fisiologia humana

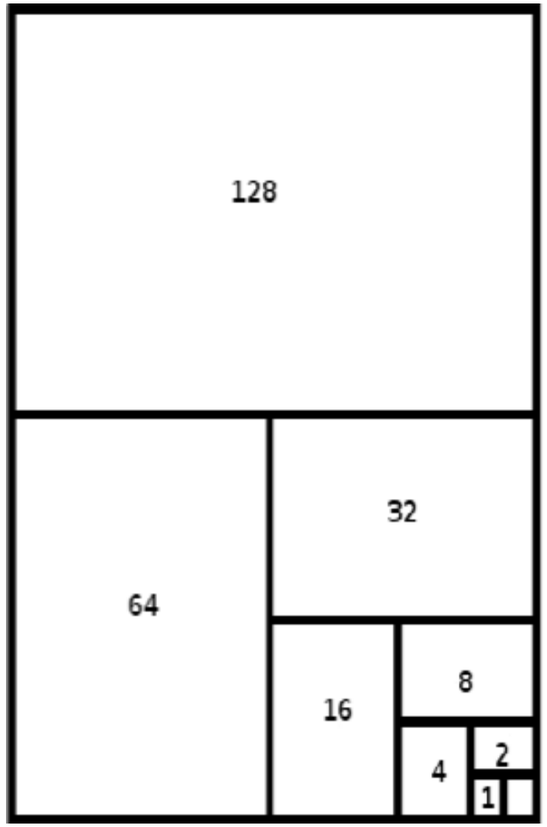


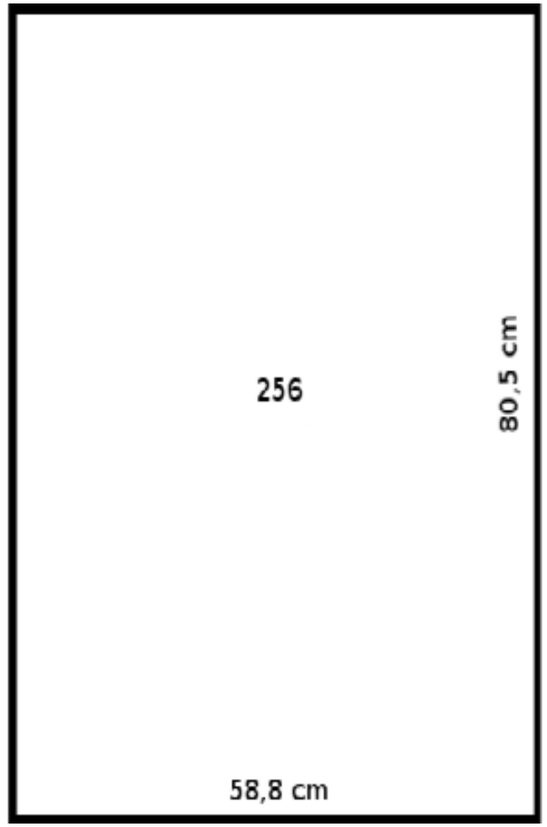




Procedimento

- Cada grupo receberá folhas de papel para criar bolas de diferentes massas e diâmetros
  - Processo de cortar a folha de papel em metades, criando nove bolinhas
  - Esperar alguns minutos para acomodar





Padrão de cortes

Fractal geometry in crumpled paper balls

M. A. F. Gomes
Departamento de Física, Universidade Federal de Pernambuco, 50.000 Recife, PE, Brazil

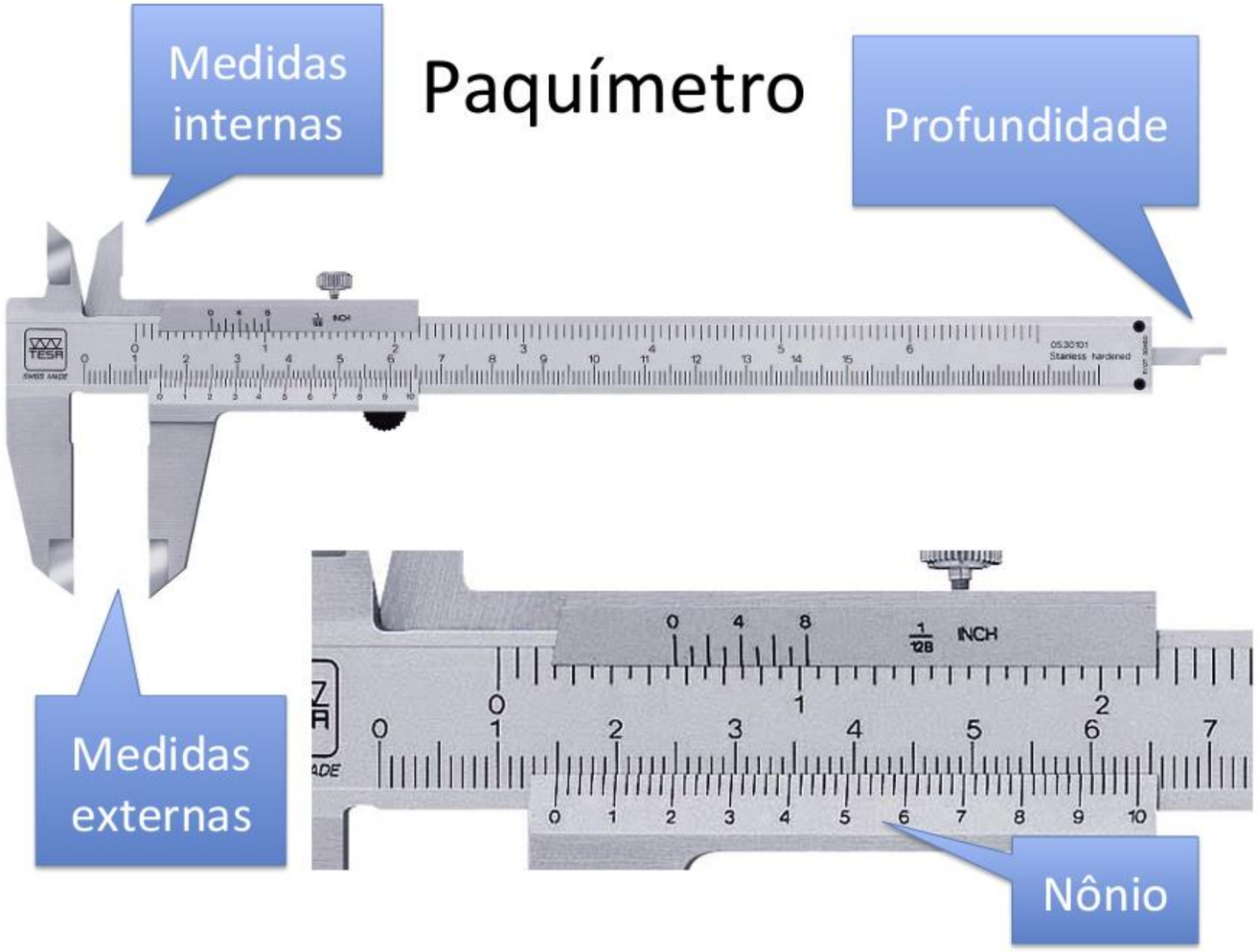
(Received 11 December 1985; accepted for publication 6 October 1986)

The geometry of crumpled paper balls is examined. The analysis stresses some physical, mathematical, and intuitive aspects of the problem, introducing the concept of fractal dimension which underlies many areas of modern physics.

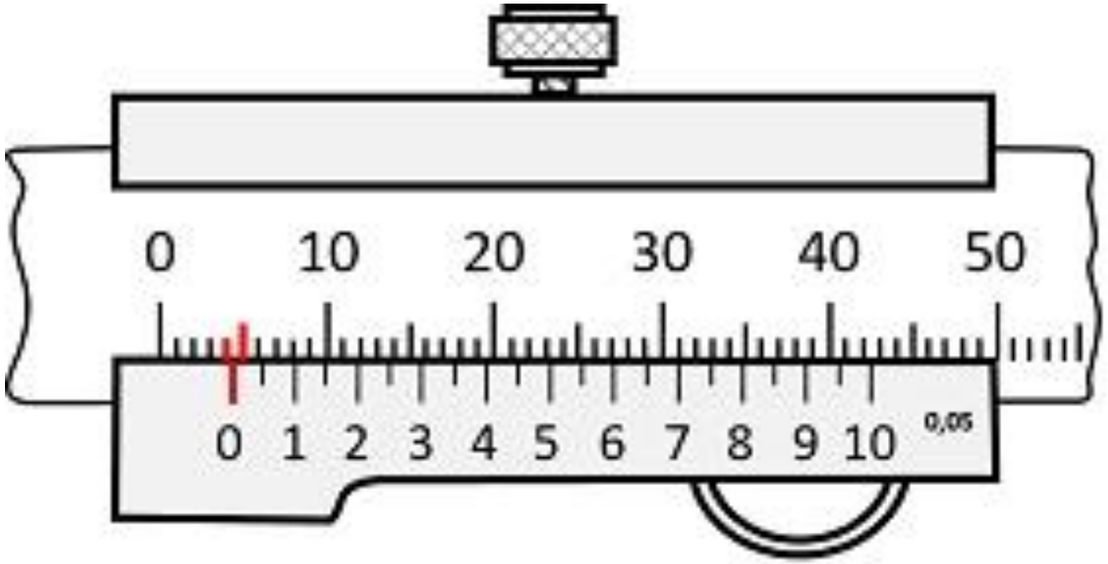
ACKNOWLEDGMENTS

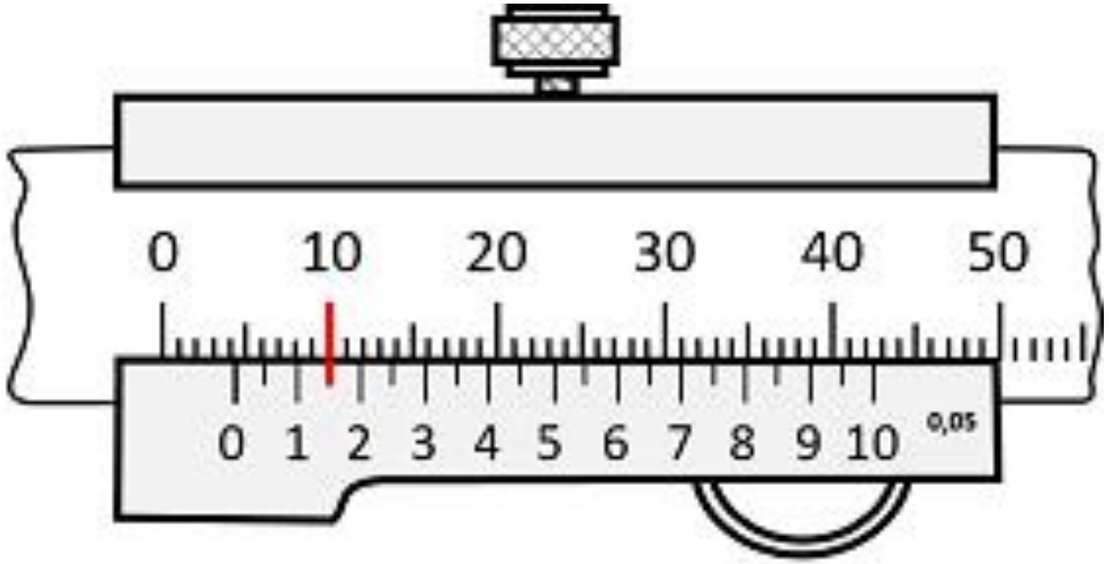
I acknowledge Professor B. B. Mandelbrot for helpful criticism and encouragement. Work supported in part by FINEP and CNPq (Brazilian Agencies).

Paquímetro


Medidas internas
Paquímetro
Profundidade
Medidas externas
Nônio

Paquímetro





4,15mm

Hipóteses e documentação

Bolas de papel - Planilhas Google

Sumário – 23/08/2023

- Reducionismo vs Complexidade
- Modelos Físicos

Devolutiva:

- Como foi a aula hoje ? (Moodle)

https://forms.gle/XJeKuhpYY5PPfr897